

(We claim:

37. A method of making a modified allergen which is less reactive with IgE comprising:

(a) identifying one or more IgE binding sites in an allergen, the one or more IgE binding sites being ones that are recognized when the allergen is contacted with serum IgE from an individual that is allergic to the allergen;

(b) modifying the allergen by mutating at least one amino acid in one or more IgE binding sites;

(c) screening for IgE binding to the modified allergen using serum IgE from an individual that is allergic to the allergen; and

(d) selecting the modified allergens which have decreased binding to IgE as compared to the unmodified allergen.

38. The method of claim 37 further comprising screening for activation of T cells that have been cultured from an individual that is allergic to the allergen and selecting the modified allergens which activate the T cells in substantially the same way as the unmodified allergen.

39. The method of claim 37 further comprising screening for binding of the modified allergen to IgG using serum IgG from an individual that is allergic to the allergen and selecting the modified allergens which bind IgG in substantially the same way as the unmodified allergen.

40. The method of claim 37 wherein the modified allergen is mutated in the center of one or more of the IgE binding sites.

41. The method of claim 37 wherein the modified allergen is mutated by substitution.

1 42. The method of claim 41 wherein the modified allergen is mutated by substituting  
2 a hydrophobic amino acid in the center of one or more of the IgE binding sites with a  
3 neutral or hydrophilic amino acid.  
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5 43. The method of claim 37 wherein the modified allergen is a portion of the allergen.  
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7 44. The method of claim 37 wherein the modified allergen is formulated with an  
8 adjuvant selected from the group consisting of IL-12, IL-16, IL-18, IFN $\gamma$  and immune  
9 stimulatory oligodeoxynucleotide sequences containing unmethylated CpG motifs which  
10 cause brisk activation and skew the immune response to a Th1-type response.  
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12 45. The method of claim 37 wherein the modified allergen is screened for initiation of  
13 a T cell helper 1 response.  
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15 46. The method of claim 37 wherein the modified allergen is made in a recombinant  
16 host selected from the group consisting of plants, animals, bacteria, yeast, fungi, and  
17 insect cells.  
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19 47. The method of claim 37 wherein the modified allergen is made in cells using site  
20 specific mutation.  
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22 48. The method of claim 37 wherein the modified allergen is made from a peanut  
23 allergen selected from the group consisting of Ara h 1, Ara h 2, and Ara h 3.  
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25 49. The method of claim 37 wherein the modified allergen is based on a protein  
26 obtained from a source selected from the group consisting of legumes, milks, grains,  
27 eggs, fish, crustaceans, mollusks, insects, molds, dust, grasses, trees, weeds, mammals,  
28 birds, and natural latexes.  
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30 50. The method of claim 37, wherein the step of modifying includes mutating at least  
31 one amino acid in all the IgE epitopes of the allergen.

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2 51. The method of claim 37, wherein the at least one IgE epitope is one that is  
3 recognized when the allergen is contacted with a pool of sera IgE taken from a group of  
4 at least two individuals that are allergic to the allergen.

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6 52. A method of making a modified food allergen which is less reactive with IgE  
7 comprising:

8 (a) identifying one or more IgE binding sites in a food allergen, the one or  
9 more IgE binding sites being ones that are recognized when the food allergen is contacted  
10 with serum IgE from an individual that is allergic to the food allergen;

11 (b) modifying the food allergen by mutating at least one amino acid in one or  
12 more IgE binding sites;

13 (c) screening for IgE binding to the modified food allergen using serum IgE  
14 from an individual that is allergic to the food allergen; and

15 (d) selecting the modified food allergens which have decreased binding to IgE  
16 as compared to the unmodified food allergen.

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18 53. The method of claim 52 wherein the modified allergen is based on a protein  
19 obtained from a source selected from the group consisting of legumes, milks, grains,  
20 eggs, fish, crustaceans, and mollusks.

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22 54. The method of claim 53 wherein the modified allergen is based on a protein  
23 obtained from a source selected from the group consisting of wheat, barley, cow milk,  
24 egg, codfish, hazel nut, soybean, and shrimp.

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26 55. A method of making a modified peanut allergen which is less reactive with IgE  
27 comprising:

28 (a) identifying one or more IgE binding sites in a peanut allergen, the one or  
29 more IgE binding sites being ones that are recognized when the peanut allergen is  
30 contacted with serum IgE from an individual that is allergic to the peanut allergen;

1 (b) modifying the peanut allergen by mutating at least one amino acid in one  
2 or more IgE binding sites;

3 (c) screening for IgE binding to the modified peanut allergen using serum IgE  
4 from an individual that is allergic to the peanut allergen; and

5 (d) selecting the modified peanut allergens which have decreased binding to  
6 IgE as compared to the unmodified peanut allergen.

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8 56. The method of claim 55 wherein the modified peanut allergen is made from a  
9 peanut allergen selected from the group consisting of Ara h 1, Ara h 2, and Ara h 3.

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11 57. The method of claim 37, 52, or 55, wherein the step of modifying includes  
12 modifying at least 1-6 amino acids in at least one IgE epitope of the allergen.

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14 58. The method of claim 37, 52, or 55, wherein the step of modifying includes  
15 modifying at least 1-5 amino acids in at least one IgE epitope of the allergen.

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17 59. The method of claim 37, 52, or 55, wherein the step of modifying includes  
18 modifying at least 1-4 amino acids in at least one IgE epitope of the allergen.

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20 60. The method of claim 37, 52, or 55, wherein the step of modifying includes  
21 modifying at least 1-3 amino acids in at least one IgE epitope of the allergen.

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23 61. The method of claim 37, 52, or 55, wherein the step of modifying includes  
24 modifying at least 1-2 amino acids in at least one IgE epitope of the allergen.

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26 62. The method of claim 37, 52, or 55, wherein the step of selecting includes  
27 selecting the modified allergens which bind to IgE at levels that are less than about 1% of  
28 those observed with the unmodified allergen.